19th /Nov/2014 Share & Care Group

- "The genetic code of Protein synthesis"
- 1st lecture "The genetic code"

* Metabolism → Catabolism . "cutting"
→ Anabolism . "building"

◆ Anabolism : Is to use the small nutrients to build the bulk units.

▲ Anabolism of Carbohydrates can be done "easily" by reversing the catabolism , "pyruvic acid → glucose → glycogen"

▲ How to build up proteins?

This process happens after the catabolism "Digestion → absorption" inside your body" and gives amino acids, the the Cell decides what type of protein it needs" • enzymes • building proteins • hormones • Secretions ...etc"

All that happens by the "Protein synthesis"

- In order to make proteins we need some reference .. the reference is "DNA" "nucleic acid" which's found inside the nucleus & contains "nucleotides"
- Nucleotides arrangement is very precise, this arrangement determines the type of amino acids that produced.

- To make protein a certain gene in the DNA will become active.

- • DNA inside the nucleus is a chromatin material "befor division"
  • DNA become as chromosomes "During division".

46 chromosom ⇒ each contains one DNA molecule.

 Coiling the DNA & shortining its shape is done by "Histones" proteins

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Life = is protein & DNA contain the protein, so the reference of protein synthesis should be kept away from any-thing can affect it, this plase is the "nucleus".

- "expression": the process of "transcription" → to make protein.
- Inside the chromosom the DNA is <u>coiled</u> but someplaces are linear, another places are more coiled and can't be "expressed"

* Why is the coiling of DNA is shown more is some places than the others? ":)

A: Because these places are more connected to the "Exons". these highly coiled places can't be <u>expressed</u>.

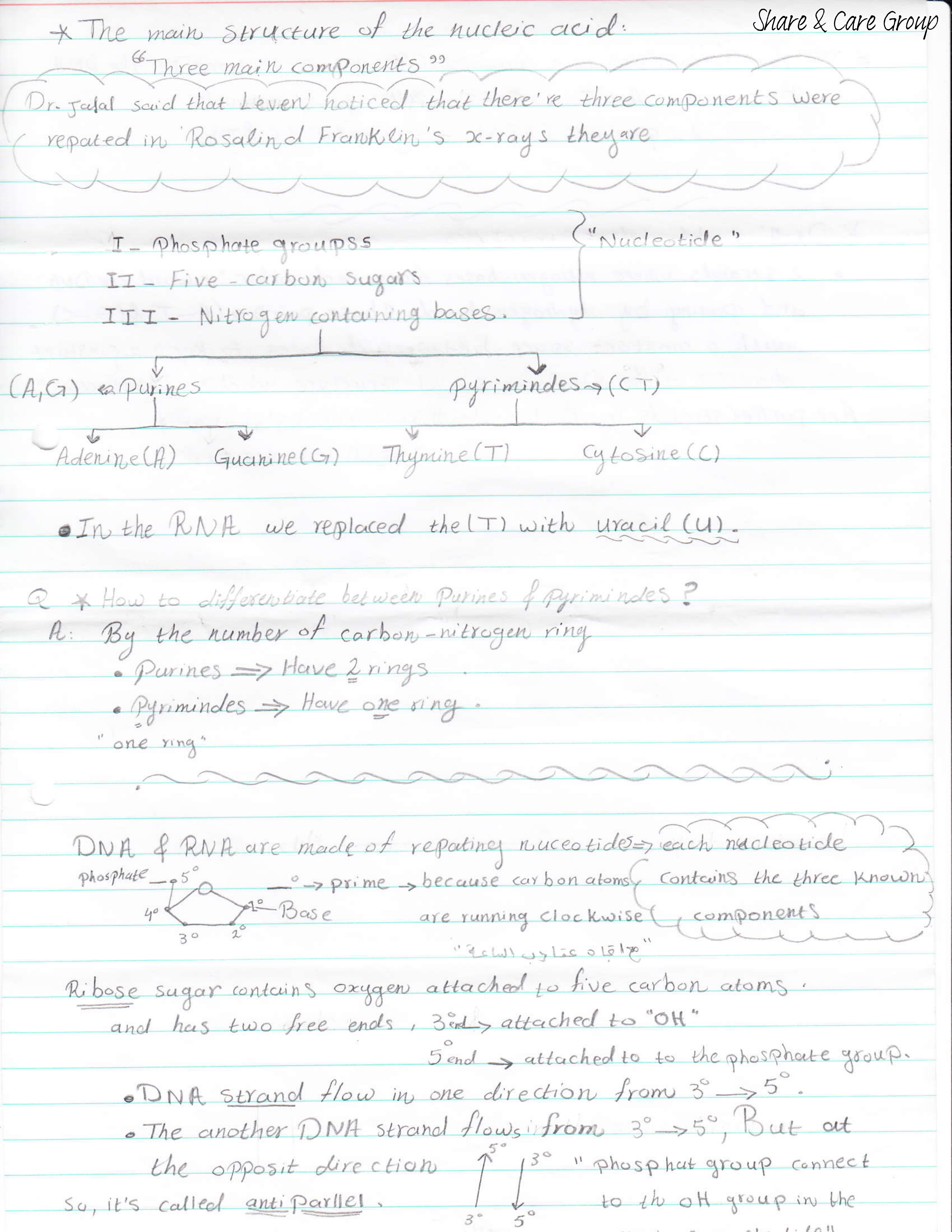
Highly coiled places "not expressed" "can't be opened" > Linear places "opened" "Can be expressed" 3% only.

"علم الوراثة"

* Genetics showed before the DNA appearence.

important info
- sperm is only about ⇒ nucleus
- ovule is a cell with a cytoplasm.

1:22 2:13



* The main structure of the nucleic acid:

"Three main components"

Dr. Jalal said that Leven noticed that there're three components were repated in Rosalind Franklin's x-rays they are

I- Phosphate groupss
II- Five-carbon sugars
III- Nitrogen containing bases.
} "Nucleotide"

- (A,G) ← Purines
  - Adenine (A)
  - Guanine (G)
- Pyrimindes → (C T)
  - Thymine (T)
  - Cytosine (C)

- In the RNA we replaced the (T) with uracil (U).

Q * How to differentiate between Purines & Pyrimindes?

A: By the number of carbon-nitrogen ring

- Purines ⇒ Have 2 rings.
- Pyrimindes ⇒ Have one ring.

"one ring"

DNA & RNA are made of repating nuceotides ⇒ each nucleotide contains the three known components

° → prime → because carbon atoms are running clockwise
"باتجاه عقارب الساعة"

Ribose sugar contains oxygen attached to five carbon atoms.
and has two free ends, 3° end → attached to "OH"
5° end → attached to to the phosphate group.

- DNA strand flow in one direction from 3° → 5°.
- The another DNA strand flows from 3° → 5°, But at the opposit direction

So, it's called antiparllel.

"phosphat group connect to th OH group in the

- The four nucleotides are found in different proportions In the DNA
  But :- 1- A = T , G = C → Allways / = : equals
  2 - purines (A & G) = Pyrimidnes (C & T).

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* DNA double helix structure

- 2 strands where nitrogen bases facing each other "inward the DNA" and pairing by hydrogen bonds «base pair» → (A—T) & (G—C) with a constant space between the bases, to keep a constant diameter of the DNA antiparllel structure which's "2 nanometer"

Antiparllel strands in Arabic: * خيطان متوازيان / متعاكسان في الاتجاه
"موضح في الصفحة السابقة".

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"Replication of DNA"

The gene : Any part of the DNA can be expressed, found in the places that are easy to open. (3%) or (7%)

* Not all the DNA is genes, because we have highly coild places, and as we said they can't be opened.

-[Inside your DNA 4 billion bases are found]

-[" " " 40,000 genes are found]

* However knowing genes, and there places wasn't enough, so scientists determined the beginings and ends of these genes too because without knowing them this science becomes useless or not understood. *

By specifying where genes start & end, scientists could detect (find) the genetic diseases.

- DNA is the only molecule that can replicat "copy" itself. "In cell division"

* How to differntiate between "Replication" & "Transcription"?

- Replication : Is making another DNA molecule for the daughter cells.

- Transcription : Is the synthesis of RNA from DNA template.
  like "RNA" = P

like:

* Women without her man is nothing => without the punctuation.
  women without her, man is nothing => with the punctuation has an extreme different meaning.

Replication occurs inside the nucleus, the DNA is replicated but not the chromosome, means one chromosome can contain 2 DNA instead of one by replication the parent DNA to give the daughter strands.

-[Rule: The chromosome can't be replicated]-

The highly coiled places which open only during the replication and open after the "replication origin", these highly coild places are opened by enzymes.

"Replication origin": The linear places, and they open first, which is a specific sequence of nucleotides.

By opening the replication origin, we have this shape

1 * the DNA step by step starts to be opened and the two strands separate at the end, by specific proteins & enzymes.

* Hydrogen bonds are weak so they can be be broken down by increasing the temprature or adding acid (changing PH).

2- After separating the parent strands, the nucleotides that are already existed in the nucleus "come from catabolism of the digested food", they start to make "base pairing" with the daughter strands.

*Replication of DNA in 5 steps

1 - The unwinding proteins keep the two strands separated and away from each other, the "Helicase" a specific enzyme moves between the two strands and cut the hydrogen bonds.
"The result: two separated strands, which are kept separated by the unwinding proteins" → these proteins remove the histones"

2 - Now in the "Building a primer", the nucleotides in nucleus try to start base pairing with the separated strands, because their nucleotides are able to make base pairing with the another nucleotides, to build up a "primer", which helps in DNA replication.
The primer: Is a sequence of (10-12) nucleotides, it's the basic unit in building the new DNA".

- The requirments for building up a new DNA:
  1 - A primer: RNA "A short stretch of RNA".
  2 - RNA polymerase.

* RNA polymerase bind the RNA and fixes it to the DNA strand, to make the building unit of the new DNA.

The two separated strands are:
1 - Leading strand: 3° → 5°, its compelated strand 5° → 3°
2 - Lagging strand: "Okazaki fragements" 5° → 3°, its compelated strand 3° → 5°

* The process of building the leading strand is easier than the lagging strand.

3- Assembling complemenitry strands:

Building the new strands, the replication starts from 5° → 3° so it's easy to form a continous copy, by using an RNA primer. But the okazaki fragments complemnting strands forming is harder or more difficult because another RNA primer is needed everytime that the process stops.

▲ DNA polymeras III (3), that catalyzes the formation of the complementary strand on the template strand, more specificly it helps the nucleotides to bind to the template strands to form the complementary strands.

4- Removing the primers:
DNA polymerase I (1) remove the primers from the lagging strands, gaps now formed between the nucleotides, which are filled by the DNA polymerase III (1) that fills them with nucleotides.

5- Joining the okazaki fragments:
The DNA ligase joins "يثبّت" the fragments to the lagging strand and makes it as a continuous strand.

- "Enzymes work together at the same time"
- The whole process occurs in the whole DNA.
- "Semiconservative replication": The parellel molecule of DNA gives two daughter molecule contains one strand from the parent, in each new chromosomes has one strand of the parent & the other is a complemntary strand, this way keeps the genetic material.

- DNA polymeras I (1) doesn't remove the first RNA primer, which causes alot of faulty that result as genetic diseases like disorders in some enzymes or some of them aren't existed